DOCUMENT RESUME

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By-Kederis, Cleves J. And Others
Training for Increasing Braille Reading Rates Final Report
American Printing House for the Blind, Louisville, Ky
Spons Agency-Vocational Rehabilitation Administration (DHEW), Washington, D.C.
Pub Date 14 Oct 64
Note-15p.
EDRS Price MF-$0.25 HC $0.85
Descriptors-*Braille, *Exceptional Child Research, *Motivation, Pacing, Positive Reinforcement, *Reading, Reading Comprehension, Reading Speed, Reading Tests, Tachistoscopes, Teaching Machines, Test Results.

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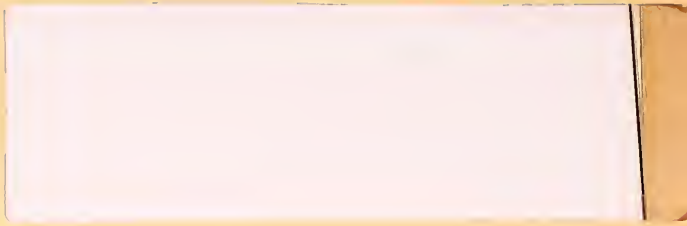

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Two studies used controlled exposure devices in attempts to improve braille reading. The three null hypotheses tested were that reading practice under controlled exposure does not increase reading rates, any increase will not be maintained, and no differences in comprehension occur because of practice. Subjects were selected by the Gates Basic Reading Test and randomly assigned to experimental and control groups. The first group of three subjects in grades 6 to 12 was divided into fast, average, and slow readers at each of three grade levels, while the second study chose the 16 highest and 16 lowest scorers. The first study trained the experimental subjects in 22 half-hour sessions on consecutive days with the tachistotactometer, and reading test forms were administered one month prior to training, immediately following training, and 1 to 2 months after training. In the second study, experimental subjects practiced paced reading (with attempted increases of two and one-half words per minute each day) for 20 half-hour sessions on consecutive days, using two books with vocabulary grade levels 5 to 9 and 7 to adult on the IBM Braille Reading Machine. The null hypotheses were confirmed in both studies. Significant reduction in reading time occurred on the motivated tests in both students ($p<.001$ and $p<.01$ respectively) in all the experimental and control groups. (DF)

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American Printing House for the Blind
INCORPORATED
FINIS E DAVIS, VICE PRESIDENT AND GENERAL MANAGER
1839 FRANKFORT AVENUE
MAILING ADDRESS P.O BOX 6085
LOUISVILLE, KY. 40206
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Training for Increasing Braille Reading Rates

Final Report: VRA Grant RD-1086s-63

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Acknowledgments

Mr. Cleves J. Kederis is the principal author of this report. Miss June E. Morris served as research assistant in the project. Overall director of the project was Dr. Gerson Y. Nolan.

The site of the first study was the Illinois Braille and Sight Saving School. Dr. Everett E. Wilcox, Superintendent, and his staff contributed significantly to the project. Mr. Julius F. Curtis, school psychologist, contributed through scheduling and overall supervision of the training program.

The site of the second study was the Kentucky School for the Blind. Mr. L. P. Howser, Superintendent, and his staff contributed significantly to the project. Mrs. Lore Ennis, of the American Printing House, helped supervise the training.

The project staff wish to express their appreciation to the faculties and student bodies of both schools for their willing cooperation in these studies.

Training for Increasing Braille Reading Rates

Braille reading is exceptionally slow when compared with print reading. Comparative word rates for senior high school students are 251 words per minute for sighted readers (Harris, 1947, p.449) and 90 words per minute for braille readers (Ethington, 1956, p. 21). Any means that would increase the rate of reading braille would have educational value by reducing the gap in rate of information intake between the two groups.

The literature on print reading is replete with studies reporting the successful use of controlled exposure devices for improving "perceptual span" and/or reading rate (Vernon, 1931; McCullough, 1958). In the area of braille reading, though, no such studies exist. Ashcroft (1959) evaluated the IBM Braille Reading Machine, which was a type of controlled exposure pacing device, for its potential as a medium for reading braille. One of his findings was a median increase of 25% in the reading rates of nine adult braille readers who had read ordinary fictional material on the machine for 2-20 hours. The increases were not conclusively demonstrated to have resulted from reading on the machine because that was not the purpose of the evaluation. However, the finding, along with the success of controlled exposure devices in improving visual reading, suggests the possible beneficial use of such devices in training programs designed to increase braille reading rates.

The present paper reports two studies that used controlled exposure devices in improvement programs for tactual reading. The hypotheses tested in both studies were the same:

1). Practice in braille reading under conditions of controlled exposure does not significantly increase rates for reading braille in ordinary form.

2). Any significant increases in braille reading rates resulting from practice are not maintained after the termination of practice.

3). No differences in comprehension occur as a result of practice.

Increasing Braille Reading Speed: Effects of Practice under Conditions of Successively Reduced Exposed Times

This study used a device analogous to the tachistoscope for training. The instrument, called a tachistotactometer, was box-like in shape. Centered in a frame along the back half of the top was a thin brass reading screen perforated with holes which corresponded to a line of 36 braille cells. Under the screen there was a rubber covered metal plate that could be raised vertically by means of electromagnets. Braille material was placed on this plate and registered with the holes in the screen. Activation of the circuit caused the metal plate to rise and press the braille through the screen so that it was accessible for reading. Time of activation of the circuit was controlled by an interval timer. The period of time the material could be exposed was variable from .02 second upward in steps of .01 second.

The materials used for practice were patterned after the Dolch reading improvement materials. They consisted of words, phrases, and sentences of successively increasing length. There were 28 sheets of practice materials in all. Sheet number one contained thirty-six, two to four cell words, and sheet number 28 contained nine, 23-26 cell phrases and sentences. The length of words and phrases increased approximately one cell per page.

Subjects

The 30 subjects were selected from 62 braille readers in grades 6-12 at the Illinois Braille and Sight Saving School. The Gates Basic Reading Test, Type A, Form 1 was used to determine reading rates and comprehension scores. Within grade levels 6 and 7, 8 and 9, and 10-12 the subjects were ranked on these measures and classified as fast, average, and slow readers. From each of the three grade levels, ten subjects at each of the reading skill levels were matched on reading time and comprehension, and randomly assigned to the experimental or control group. Subject data is contained in Table 1. A more complete breakdown of reading times by level of reading skill is provided in Table 2.

Table 1

Descriptive Data of Experimental and Control Subjects

		Reading Time (min.)	Comprehension Score	Grade	Sex M	Sex F
Experimental	Mean	32.45	23.00	8.80	5	10
	S.D.	12.93	.89	1.83		
Control	Mean	32.14	23.27	8.80	4	11
	S.D.	13.06	.93	2.01		

Procedure

The complete experiment required 26 sessions. In four sessions, each of one hour duration, all of the subjects took the four equivalent forms of the Gates Basic Reading Test, Type A. In the other 22 sessions, the subjects in the experimental group were trained. The training sessions were one-half hour long and took place on consecutive school days.

The first reading test, Form 1, was administered to the group of 62 braille readers approximately one month prior to the training program. Form 2 of the Gates tests was administered to the 30 experimental and control subjects immediately following training. This test was given under motivated conditions, i.e., an award of five, three, and one dollar(s) was given to the three individuals who reduced, proportionately, their initial reading times the most while maintaining their previous comprehension level. Form 3 and 4 of the reading tests were given under unmotivated conditions one and two months, respectively, subsequent to training.

Depending on their class schedules, the experimental subjects were trained during one of four sessions that were held in the afternoon and evening of each day. All of the sessions were conducted in one large room. The subjects were seated near each of the four corners of the room. During each session, there was one monitor for every two subjects. The monitor's function was to record the progress of the subjects, check identification of the materials, and regulate the timers. The monitors were senior college students majoring in psychology at McMurray College and Illinois College in Jacksonville, Illinois.

On the first day of training, the subjects were read the Instructions (Appendix 1) and were shown how to operate the tachistotactometer. To determine whether they understood and could do the task, the subjects practiced on the first sheets of the training materials.

At this time the initial exposure time was determined for each subject. By the beginning of the third session, when all the subjects had indicated they could do the task, formal training was begun.

The training required the subjects to read the practice words, phrases, and sentences at diminishing intervals of time in order to keep constant pressure on the subject to read faster. Each subject began reading the materials at an exposure time long enough for him to touch all of the characters but not necessarily identify the words. Reductions of .05 second were made in the exposure time wherever a complete and different line of the material on a sheet was accurately identified. Each day of training, the subjects were provided with a new set of stimulus materials. The length of the stimulus words and, eventually, of the stimulus phrases was increased each day. Between sessions the exposure time was increased .2 second over the lowest time achieved during the previous session to allow for the increase in number of characters on the successive sheets of materials. These procedures held throughout training unless the subject fell behind or could not identify any of the words. In such instances the exposure time was increased until some of the words were identified.

Results

In Table 2 are listed the mean reading times and mean comprehension scores for fast, average, and slow readers in the experimental and control groups on the four forms of the Gates Basic Reading Tests which were administered during the experiment. Also included in Table 2 are mean reading time and comprehension scores and their standard deviations for the total groups. The significance of differences between pairs of means was tested by the t-test using the standard error of the differences between correlated measures as described by McNemar (1955, p.90).

The results indicated that training had little effect on the reading behavior of the experimental subjects. What little difference in average reading time there was between the experimental and control groups favored the control group although this difference was not significant. Both the trained and untrained groups reduced their reading times on test two from that on test one by 21% (significant beyond the .001 level). Over a period of the next two months, on tests three and four this reduction was increased to 26%.

Within levels of reading ability, the average and slow control subjects combined reduced their average reading times on test two more than their experimental counterparts. The differences were 30% and 20%, respectively, for the two groups. On the other hand, the fast experimental readers reduced their reading time by 23% compared with 5% for their controls. These differences held up over the next two tests, but did not reach statistical significance.

In comprehension, both the experimental and control groups fell

off slightly on test two. These losses occurred primarily in the average and slow readers of the experimental group and the slow readers of the control group. Subsequent reductions in average reading times on tests three and four were accompanied by a greater loss in comprehension by the control group, up to 4%, while the loss by the experimental group remained the same. Again the average and slow readers were responsible for the decrement. Only the fast experimental subjects managed to improve their comprehension and maintain the improvement throughout.

Table 2

Means and Standard Deviations
of Reading Times and Comprehension Scores

		Tests							
		1		2		3		4	
		R.T.	Comp.	R.T.	Comp.	R.T.	Comp.	R.T.	Comp.
Experimental Group	Fast	18.42	23.00	14.22	23.60	14.52	23.60	15.19	23.40
	Aver.	30.91	23.00	26.45	22.20	24.80	22.20	24.07	22.20
	Slow	48.02	23.00	35.37	22.80	34.54	23.20	33.96	23.00
	Mean	32.45	23.00	25.34	22.87	24.62	23.00	24.39	22.87
	S.D.	12.93	.89	9.31	1.31	9.12	1.46	8.80	1.09
Control Group	Fast	18.35	23.60	17.38	23.80	15.93	23.40	16.71	23.60
	Aver.	30.35	23.40	22.01	23.40	22.05	22.40	18.56	23.20
	Slow	47.73	22.60	32.23	21.20	31.84	20.80	28.31	20.40
	Mean	32.14	23.27	23.37	22.80	23.27	22.20	21.19	22.40
	S.D.	13.06	.93	7.84	1.72	8.77	1.47	6.54	2.12

Increasing Braille Reading Speed: The Effects of Pacing Training

In this study the IBM Braille Reading Machine was used to control the presentation rate of practice material. In shape, the instrument was box-like. On the front third of the top surface was a flat area where the reader placed his hands. Immediately behind this area was a continuous rubber belt that revolved on two shafts approximately eight inches apart. In the center of the belt and running its entire length were holes spaced according to the dimensions of a line of braille cells. These holes contained metal pegs the size of braille dots that could be exposed above the surface of the belt to represent braille characters. Located on the back two-thirds of the top surface was a tape reading mechanism and a presentation rate indicator. The selection of the metal pegs to be exposed was controlled by a punched paper tape. The movement of the rubber belt was regulated by a variable speed motor. The device provided for the display of a continuous line of braille that could be varied in rate from 50-250 words per minute.

The materials used in training were two books The Rainbow Book of Nature by Donald C. Peattie, a literary naturalistic work, and They Saw America First by Katherine Balcless, a literary historical work. The vocabulary levels as listed in the American Printing House for the Blind catalog are 5th through 9th grades and 7th grade through adult, respectively.

Subjects

The subjects were selected from 48 braille readers in grades 5-11 at the Kentucky School for the Blind. They were chosen to represent two levels of reading ability, fast and slow. Two weeks prior to the beginning of the training program Form 1 of the Gates Basic Reading Test, Type A, was administered to all 48 braille readers. All those who scored below 19 on comprehension were eliminated from consideration. The reading times of the remainder were ranked from high to low. From the upper and lower halves of this distribution, 16 subjects were matched as close as possible on reading time and grade level. The 32 subjects were then randomly assigned to either the experimental or control group. One subject in the slow experimental group transferred to another school midway through training. Accordingly, his control was excluded from the analysis. Subject data can be found in Table 3..

Table 3

Subject Data for Reading Pacing Study

		Reading Time (min)	comprehension Score	Grade	Sex M	Sex F
Slow Readers	E Mean	35.87	20.86	6.57	3	4
	S.D.	4.61	1.46	1.29		
	C Mean	35.24	22.43	6.71	4	3
	S.D.	3.79	.90	1.03		
Fast Readers	E Mean	22.72	22.88	8.12	4	4
	S.D.	2.95	.78	2.03		
	C Mean	23.17	23.38	7.88	4	4
	S.D.	2.59	.99	1.69		

Procedure

Completion of the study required approximately two and one-half months. Since only one machine was available and only one person at a time could use the machine, the study was carried out in two phases. The slow readers were trained during the first phase and the fast readers during the second.

Three sessions of approximately one hour each were used to administer equivalent forms of the Gates Basic Reading Test, Type A to the experimental and control subjects in groups. The tests were administered according to the instructions for use with the blind. Forms 1 and 2 were given two weeks and two days, respectively, prior to training, and Form 3 was given immediately after training. Forms 2 and 3 were given under motivated conditions. The three individuals who made the greatest proportionate reduction in their previous reading rates received a monetary reward. Form 2 was given prior to training to establish a base for judging the effects of training.

The experimental subjects practiced paced reading during 20 one-half hour sessions. The training sessions were held in the same room on consecutive school days at the same time of day for each subject. At the opening of the first session the investigator read the instructions (Appendix II) and explained the operations of the machine to the subjects. For the remainder of the first session and all of the second session the subjects read from the machine at their beginning word rates. The first two sessions were used to allow the subjects to adapt to the different form of reading. Each subject's beginning word rate was his reading time of the second test (the first motivated test). On the third day of training, pacing of the subject's reading began.

Pacing consisted of increasing the presentation rate of the material two and one half words per minute each day. The rate was increased without the subject's knowledge approximately five minutes after the start of each session. If the subject could not read at the increased rate he continued reading for the remainder of the session at the next lower rate at which he was reading satisfactorily. To check comprehension of the material, the subject, after each ten minutes of reading, had to relate briefly what he had just read. The verbal report was evaluated for general significance, detail, and continuity of the facts.

Results

Training appeared to progress satisfactorily. The subjects were enthusiastic throughout and most all reported they seemed to read their classroom and outside material faster. On the last day of training, the records showed the slow readers had achieved an average gain in reading rate on the machine of 25%, 88.30 words per minute to 111.50 words per minute. However, one subject who more than halved his reading time on the second test could not read at this rapid rate, and finished training with a 11% loss in reading time over the initial motivated test rate. Excluding this subject, the average gain for the slow group was 51% The average gain in reading rate for the fast readers was 31%, 118.80 wpm to 155.30 wpm. In both groups the gains in reading speed were made without too great a change in comprehension as determined by the subject's verbal report. The greatest decrement in comprehension appeared in the area of recalling specific facts or details in the content.

The data that were analysed to detect any changes in reading rate were the mean reading times for the three forms of the Gates Basic Reading Tests. The significance of differences between pairs of means was tested by the t-test using the standard error of the differences between correlated measures as described by McNemar (1955, p.90). Mean reading times and comprehension scores for the four groups on each of the tests can be found in Table 4.

Again, large, significant ($p < .01$) reductions in reading times of 24% and 33% were achieved on test two and three, respectively, by both the experimental and control groups combined. A comparison of the reading times of the experimental and control groups on test three showed a 4% greater reduction by the experimental group. However, this difference was not significant.

On test three the slow readers in both the experimental and control groups reduced their reading times approximately the same, 15% and 17% respectively. On the other hand the fast experimental readers reduced their reading times by 10% compared with no reduction by their controls. A test of reading times of just the fast readers showed that this 10% difference was significant at the .02 level, which seemed to indicate a differential effect of training on the fast readers.

However, when the overall reduction in reading time from test one to test three was considered only a non-significant 2% difference was found, and this was interpreted as indicating some factor other than training at work.

In comprehension the fast experimental and control subjects did about the same, an overall loss from test one to test three of 1%. The overall loss for slow trained readers was 11%, while that for the slow untrained readers was 5%.

Table 4

Mean Reading Times and Comprehension Scores of Experimental and Control Subjects Showing Differences following the Introduction of a Monetary Reward (Test 2) and Pacing Training (Test 3).

		Test 1		Test 2		Test 3	
		R.T.	Comp.	R.T.	Comp.	R.T.	Comp.
Experimental Group	Fast	22.72	22.88	18.22	22.13	16.36	22.63
	Slow	35.87	20.86	25.60	19.43	21.66	17.29
Control Group	Fast	23.17	23.38	17.23	22.50	17.19	23.13
	Slow	35.26	22.43	28.14	22.29	23.41	21.14
Total	Mean	28.83	22.33	21.99	21.63	19.46	21.17
	S.D.	7.22	1.37	7.60	2.43	6.94	4.11

Discussion

The results of the two studies showed that reading training of the kinds specified had no significant effects on the reading behavior of the subjects. Thus, the hypotheses in the introduction were confirmed.

The only significant change in reading was brought about apparently by motivation. Not only did it account for 22-26% average reduction in reading time by the experimental and control groups in both studies, but it was also responsible for differential reductions in reading time by levels of readers. Furthermore, in the first study it may have been responsible for sustaining the reductions over a period of two months. These effects are considerable and, in themselves, important. They point out not only the need for controlling motivation in studies such as these, but also that improvement in reading may result from manipulation of motivation in the classroom.

One other finding which seemed to be of some importance was the

possible differentiel effects of treining on the levels of reeding skill. In both studies, following treining, the fest experimentel readers excelled their controls in reeding time and comprehension. On the other hand, with the exception of the comprehension scores of the slow readers in the first study, the averege end slow control readers did better than their experimentel counterperts. The significence of these results wes tested by means of the Wilcoxon matched-pairs signed renks test (Siegel, 1956). The levels of readers from both studies were combined, and the subjects' proportions of reductions in reeding time compered. Significence at the .05 level wes found for the differences between the fest experimental and control readers, but not for the differences between the experimentel and control groups of the everage and slow readers. These findings partielly supported e similer trend observed by Ashcroft (1959, p. 3) who noted "...good readers tend to make greeter improvement than slow readers."

What might heve eccounted for these possible differential effects of treining on the levels of readers? Aside from intelligence, which cannot fully explein the differences between the groups, the units on which the subjects practiced mey have been involved. In one study they were words, phrases, and short sentences; in the second study they were sentences within the framework of ordinery reeding meteriel. Because this is the proper subject metter of reeding, it seems it should also be the proper subject metter for improving reeding. However, the meterial mey not heve been eppropriete for the different levels of readers. In e study of recognition thresholds of breille words and cherecters, Nolan and Kederis (1963) found thet e mejor fector thet differentieted fest and slow readers was speed of cherecter recognition. The fest readers recognized breille cherecters in one-half the time required by slow readers. Therefore, while the words, etc. mey heve been an eppropriete end salutery prectice unit for the fest readers, they mey heve been of no velue to the slower readers who might heve benefited more from prectice on the individuel braille cherecters.

In conclusion, the present studies, while not providing many enswers, do seem to be the besis for further exploretion of the whole area of remediel reading of breille, espeeielly when using controlled exposure devices. Motivetion, levels of reading skill, and type of prectice meteriel are ell perameters whose effects should be more fully determined.

Summary

Controlled exposure devices were used in two studies to improve breille reeding. In one, words, phreses, end sentences of increesing length were read at diminishing intervels of time. In the other, literery meterials were read et increesing word rates. Both used en experimentel end control group of 15 metched subjects who represented levels of reeding speed (fest end slow). The experimental groups precticed reeding one-half hour eech dey for 20 consecutive school days. A monetery reword served to control motivation. Differences between the experimental and control grcups on tests before and efter treining were not significent. Motivetion hed the only signifieent effect end eccounted for 22-26% everege reductions in reeding time by ell levels within both groups.

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APPENDIX I

Instructions for Controlled Exposure Study

The purpose of this study is to determine whether the type of training you undergo increases your rate of reading. Words, phrases, and sentences of increasing length will be exposed for you to read at decreasing periods of time. The diminishing times will have the effect of keeping pressure on you to read faster. You will read on the machine here before you.

(Show tachistactometer and explain operations. The subject should not press too hard on the screen.

A sheet of braille containing nine lines of words, four words to a line, will be positioned in the machine. The first character of each word will be located in the cell below the markers on the screen. In preparing for the word place your reading finger or fingers over that cell. Then, activate the circuit by means of the foot switch, and when the word appears, silently read it as rapidly as you can. If you do not recognize the word try to read the next one a little faster. Each time a word appears and you are not able to identify it, force yourself to read the succeeding words faster and faster. Similarly, read each word and each line on the sheet. Whenever you recognize a complete line of words, hold up your hand and I will check you on the words and reset the machine.

Do not worry if you are unable to recognize all of the words on a page. This is the plan of the experiment and its purpose is to force you to read faster.

In reading the words and phrases you should try to assume the same posture as you do when reading regular braille material. Use your hands and fingers just as you normally do.

If the words do not come up through the screen after you press the foot switch tell me immediately.

APPENDIX II

Pacing Training Instructions

You are now reedy to begin the pacing practice. You will be reading from the machine here in front of you for a half-hour each day over the next 20 days. This is the way it operates. (Show and explain machine).

Now here is what we will do. When reading from the machine, you should hold your hands and place your fingers over the characters in the belt just as you do in reading ordinary braille material. The reading rate will be the same speed you achieved on the last test. At this rate you should be able to follow the material. However, because this way of reading is different for you, i.e. you cannot go back over any of the text or stop anywhere, you may experience some difficulty at first. Do not let this bother you, just try to keep up with the machine and get the meaning of the material from those parts that you do read. At the end of each session I will ask you to relate what you have just read.

If after you have tried to read the material for some time, you cannot keep up with the machine, and cannot get any meaning from what you are reading you should first stop the machine, and then tell me so I can reduce the reading rate.

When you are able to read the material satisfactorily, I will increase the reading rate a small amount each day. However, I cannot tell you when I change the rate or what the speed is until you demonstrate that you can read adequately at this new rate. Do you have any questions?

If anything goes wrong with the machine, such as a particular dot appearing or failing to appear regularly, or the tape breaking, etc. push the stop button immediately before you miss too much of the material. If a word is misspelled occasionally do not bother about this.

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